

THAT WHICH IS CLAIMED IS:

1. An emboli extraction catheter and vascular filter system for insertion into a lumen of a vessel, said system comprising:

- a) a guidewire having a proximal end and a distal end;
- 5 b) a vascular filter attached near said distal end of said guidewire, said filter comprising a proximal portion, a distal portion, and a plurality of struts extending therebetween, said filter further comprising a porous flexible filter membrane, with said porous flexible filter membrane connected to said filter distal portion and said plurality of struts, said
10 porous filter membrane having a length less than the length of said plurality of struts, said vascular filter having a smaller first diameter for insertion into said lumen, and a second larger diameter for expanding to substantially equal the diameter of said lumen and to be placed in generally sealing relationship with said lumen;
- 15 c) actuating means for causing said vascular filter to move from said smaller first diameter to said larger second diameter and back to said smaller first diameter;
- d) a flexible catheter having an outer diameter and an inner diameter, a proximal end and a distal end, a proximal portion and a distal portion,
20 and an inner lumen, with said proximal end of said guidewire slidably insertable into said distal end of said catheter;
- e) a radio-opaque tip near said distal end of said catheter; and
- f) a hub permanently attached to said proximal end of said catheter, said
25 hub having an outer diameter and an inner diameter, a proximal end and a distal end, and an inner lumen, said hub further comprising a sideport and means for maintaining a seal on the guidewire, said lumen of said hub being in fluid communication with said lumen of said catheter.

2. The emboli extraction catheter and vascular filter system according to claim 1,
30 wherein said guidewire is made from Nickel-Titanium alloy.

3. The emboli extraction catheter and vascular filter system according to claim 1,
wherein said vascular filter is made from Nickel-Titanium alloy.

4. The emboli extraction catheter and vascular filter system according to claim 1, wherein said porous flexible filter membrane is made from a flexible polymeric material chosen from a group consisting of polyurethane, polyethylene or a co-polymer thereof.
5. The emboli extraction catheter and vascular filter system according to claim 1, wherein the pore size of said porous flexible filter membrane is from about 20 to about 300 microns.
6. The emboli extraction catheter and vascular filter system according to claim 1, wherein said actuating means is a sheath.
7. The emboli extraction catheter and vascular filter system according to claim 1, wherein said catheter is made from a polymeric material.
8. The emboli extraction catheter and vascular filter system according to claim 1, wherein said proximal portion of said catheter is reinforced with braid wire.
9. The emboli extraction catheter and vascular filter system according to claim 1, wherein said proximal portion of said catheter comprises a flexible coil.
10. The emboli extraction catheter and vascular filter system according to claim 1, wherein said distal portion of said catheter is constructed of lower durometer material than said proximal portion of said catheter.
11. The emboli extraction catheter and vascular filter system according to claim 1, wherein said distal end of said catheter has a fluted or serrated shape.
12. The emboli extraction catheter and vascular filter system according to claim 1, wherein said distal end of said catheter comprises a plurality of longitudinal slits.
13. A method for capturing embolic particulates within a vascular filter in the lumen of a vessel, and retrieving them at the end of the procedure, comprising the steps of:
 - a) inserting a guidewire into said lumen, said guidewire having a proximal end and a distal end, and a vascular filter attached near said distal end of said guidewire, said filter comprising a proximal portion, a distal portion, and a plurality of struts extending therebetween, said filter further comprising a porous flexible filter membrane, said vascular filter having a smaller first diameter for insertion into said lumen, and a second larger diameter for expanding to substantially equal the

diameter of said lumen and to be placed in generally sealing relationship with said lumen;

b) advancing said guidewire until said distal end of said guidewire is positioned past a vascular occlusion in said vessel;

5 c) deploying said filter in said lumen, distal to said vascular occlusion;

d) advancing additional interventional devices over said guidewire, and positioning said devices at the site of said occlusion in said vessel;

e) performing additional procedures to therapeutically treat said occlusion in said vessel;

10 f) capturing embolic particulates generated by said procedures in said filter;

g) removing said interventional devices from said guidewire;

h) slidably inserting a flexible catheter over said guidewire, said flexible catheter comprising an outer diameter and an inner diameter, a proximal end and a distal end, and an inner lumen, a radio-opaque tip near said distal end of said catheter, and a hub permanently attached to said proximal end of said catheter, said hub having an outer diameter and an inner diameter, a proximal end and a distal end, and an inner lumen, said lumen of said hub being in fluid communication with said lumen of said catheter, said hub further comprising a sideport and means for maintaining a seal on said guidewire;

i) advancing said flexible catheter over said guidewire until said radio-opaque tip is as close as possible to said proximal portion of said filter;

j) attaching a syringe to said sideport of said hub;

25 k) using said syringe to aspirate said embolic particulates from said filter;

l) removing said catheter from said lumen;

m) collapsing said filter in said lumen; and

n) removing said guidewire and said filter from said lumen.

14. A method for capturing embolic particulates within a vascular filter in the lumen of a vessel, and retrieving them during the procedure, comprising the steps of:

30 a) inserting a guidewire into said lumen, said guidewire having a proximal end and a distal end, and a vascular filter attached near said distal end

of said guidewire, said filter comprising a proximal portion, a distal portion, and a plurality of struts extending therebetween, said filter further comprising a porous flexible filter membrane, said vascular filter having a smaller first diameter for insertion into said lumen, and a second larger diameter for expanding to substantially equal the diameter of said lumen and to be placed in generally sealing relationship with said lumen;

- b) advancing said guidewire until said distal end of said guidewire is positioned past a vascular occlusion in said vessel;
- c) deploying said filter in said lumen, distal to said vascular occlusion;
- d) advancing additional interventional devices over said guidewire, and positioning said devices at the site of said occlusion in said vessel;
- e) performing additional procedures to therapeutically treat said occlusion in said vessel;
- f) capturing embolic particulates generated by said procedures in said filter;
- g) removing said interventional devices from said guidewire;
- h) slidably inserting a flexible catheter over said guidewire, said flexible catheter comprising an outer diameter and an inner diameter, a proximal end and a distal end, and an inner lumen, a radio-opaque tip near said distal end of said catheter; and a hub permanently attached to said proximal end of said catheter, said hub having an outer diameter and an inner diameter, a proximal end and a distal end, and an inner lumen, said lumen of said hub being in fluid communication with said lumen of said catheter, said hub further comprising a sideport and means for maintaining a seal on said guidewire;
- i) advancing said flexible catheter over said guidewire until said radio-opaque tip is as close as possible to said proximal portion of said filter;
- j) attaching a syringe to said sideport of said hub;
- k) using said syringe to aspirate said embolic particulates from said filter;
- l) removing said catheter from said lumen; and
- m) advancing additional interventional devices over said guidewire to complete therapeutic treatment of said occlusion in said vessel.

15. An emboli extraction catheter and vascular filter system for insertion into a lumen of a vessel, the system comprising:

- a) a guidewire having a proximal end and a distal end;
- b) a vascular filter attached near said distal end of said guidewire, said filter comprising at least one support hoop, said at least one support hoop having an articulation region, said filter further comprising a porous flexible sac affixed to said at least one support hoop at the greatest distance from said distal end of said guidewire, so that said hoop forms the mouth of said sac, said vascular filter having a smaller first diameter for insertion into said lumen, and a second larger diameter for expanding to substantially equal the diameter of said lumen and to be placed in generally sealing relationship with said lumen;
- c) actuating means for causing said vascular filter to move from said smaller first diameter to said larger second diameter and back to said smaller first diameter;
- d) a flexible catheter having an outer diameter and an inner diameter, a proximal end and a distal end, a proximal portion and a distal portion, and an inner lumen, with said proximal end of said guidewire slidably insertable into said distal end of said catheter, said catheter further comprising a perforation in said catheter distal portion, with said distal portion of said catheter distal to said perforation positioned substantially parallel to but offset from the longitudinal axis of said catheter;
- e) a radio-opaque tip near said distal end of said catheter; and
- f) a hub permanently attached to said proximal end of said catheter, said hub having an outer diameter and an inner diameter, a proximal end and a distal end, and an inner lumen, said hub further comprising a sideport and means for maintaining a seal on the guidewire, said lumen of said hub being in fluid communication with said lumen of said catheter.

16. The emboli extraction catheter and vascular filter system according to claim 15, wherein said guidewire is made from Nickel-Titanium alloy.

17. The emboli extraction catheter and vascular filter system according to claim 15, wherein said vascular filter is made from Nickel-Titanium alloy.
18. The emboli extraction catheter and vascular filter system according to claim 15, wherein said porous flexible sac is made from a flexible polymeric material chosen from a group consisting of polyurethane, polyethylene or a co-polymer thereof.
19. The emboli extraction catheter and vascular filter system according to claim 15, wherein the pore size of said porous flexible sac is from about 20 to about 300 microns.
20. The emboli extraction catheter and vascular filter system according to claim 15, wherein said actuating means is a sheath.
21. The emboli extraction catheter and vascular filter system according to claim 15, wherein said catheter is made from a polymeric material.
22. The emboli extraction catheter and vascular filter system according to claim 15, wherein said proximal portion of said catheter is reinforced with braid wire.
23. The emboli extraction catheter and vascular filter system according to claim 15, wherein said proximal portion of said catheter comprises a flexible coil.
24. The emboli extraction catheter and vascular filter system according to claim 15, wherein said distal portion of said catheter is constructed of lower durometer material than said proximal portion of said catheter.
25. A method for capturing embolic particulates within a vascular filter in the lumen of a vessel, and retrieving them at the end of the procedure, comprising the steps of:
 - a) inserting a guidewire into said lumen, said guidewire having a proximal end and a distal end, and a vascular filter attached near said distal end of said guidewire, said filter comprising at least one support hoop, said at least one support hoop having an articulation region, said filter further comprising a porous flexible sac affixed to said at least one support hoop at greatest distance from said distal end of said guidewire, so that said hoop forms the mouth of said sac, said vascular filter having a smaller first diameter for insertion into said lumen, and a second larger diameter for expanding to substantially equal the

diameter of said lumen and to be placed in generally sealing relationship with said lumen;

b) advancing said guidewire until said distal end of said guidewire is positioned past a vascular occlusion in said vessel;

5 c) deploying said filter in said lumen, distal to said vascular occlusion;

d) advancing additional interventional devices over said guidewire, and positioning said devices at said site of said occlusion in said vessel;

e) performing additional procedures to therapeutically treat said occlusion in said vessel;

10 f) capturing embolic particulates generated by said procedures in said filter;

g) removing said interventional devices from said guidewire;

h) slidably inserting a flexible catheter over said guidewire, said flexible catheter comprising an outer diameter and an inner diameter, a proximal end and a distal end, a proximal portion and a distal portion, and an inner lumen, said catheter further comprising a perforation in said distal portion, with said distal portion of said catheter distal to said perforation positioned substantially parallel to but offset from the longitudinal axis of said catheter, a radio-opaque tip near said distal end of said catheter, and a hub permanently attached to said proximal end of said catheter, said hub having an outer diameter and an inner diameter, a proximal end and a distal end, and an inner lumen, said lumen of said hub being in fluid communication with said lumen of said catheter, said hub further comprising a sideport and means for
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25 maintaining a seal on said guidewire;

i) advancing said flexible catheter over said guidewire until said radio-opaque tip is inserted into said porous flexible sac of said filter;

j) attaching a syringe to said sideport of said hub;

k) using said syringe to aspirate said embolic particulates from said filter;

30 l) removing said catheter from said lumen;

m) collapsing said filter in said lumen; and

n) removing said guidewire and said filter from said lumen.

26. A method for capturing embolic particulates within a vascular filter in the lumen of a vessel, and retrieving them during the procedure, comprising the steps of:

- a) inserting a guidewire into said lumen, said guidewire having a proximal end and a distal end, and a vascular filter attached near said distal end of said guidewire, said filter comprising at least one support hoop, said at least one support hoop having an articulation region, said filter further comprising a porous flexible sac affixed to said at least one support hoop at the greatest distance from said distal end of said guidewire, so that said hoop forms the mouth of said sac, said vascular filter having a smaller first diameter for insertion into said lumen, and a second larger diameter for expanding to substantially equal the diameter of said lumen and to be placed in generally sealing relationship with said lumen;
- b) advancing said guidewire until said distal end of said guidewire is positioned past a vascular occlusion in said vessel;
- c) deploying said filter in said lumen, distal to said vascular occlusion;
- d) advancing additional interventional devices over said guidewire, and positioning said devices at said site of said occlusion in said vessel;
- e) performing additional procedures to therapeutically treat said occlusion in said vessel;
- f) capturing embolic particulates generated by said procedures in said filter;
- g) removing said interventional devices from said guidewire;
- h) slidably inserting a flexible catheter over said guidewire, said flexible catheter comprising an outer diameter and an inner diameter, a proximal end and a distal end, a proximal portion and a distal portion, and an inner lumen, said catheter further comprising a perforation in said distal portion, with said distal portion of said catheter distal to said perforation positioned substantially parallel to but offset from said longitudinal axis of said catheter; a radio-opaque tip near said distal end of said catheter, and a hub permanently attached to said proximal end of said catheter, said hub having an outer diameter and an inner

diameter, a proximal end and a distal end, and an inner lumen, said lumen of said hub being in fluid communication with said lumen of said catheter, said hub further comprising a sideport and means for maintaining a seal on said guidewire;

- 5 i) advancing said flexible catheter over said guidewire until said radio-opaque tip is inserted into said porous flexible sac of said filter;
- j) attaching a syringe to said sideport of said hub;
- k) using said syringe to aspirate said embolic particulates from said filter;
- l) removing said catheter from said lumen; and
- 10 m) advancing additional interventional devices over said guidewire to complete therapeutic treatment of said occlusion in said vessel.